

Bilimbi Fruit (*Averrhoabilimbi*) Juice

Jessica D. Astillo, MATVE

Bohol Island State University, Poblacion Norte Clarin Bohol, Philippines

Abstract— The main thrust of this study was to determine the profile of Bilimbi Fruit (*Averrhoabilimbi*) Juice in terms of ingredients and costing, tools and equipment, procedure, shelf life, nutritive value, microbial analysis and sensory qualities and level of preferences in three different treatments in the aspect of color, flavor, aroma, and texture. The study utilized experimental design with the aid of a descriptive questionnaire that determined the sensory preferences of the respondents towards the three treatments of the juice (i.e., plain, grapes, apple) in terms of color, flavor, aroma, texture. This study was conducted at Bohol Island State University in the six campuses with one hundred eighty-two (182) purposively selected respondents who tasted and rated the juice. After the data were retrieved, these were tabulated and interpreted using the Average Weighted Mean. The Chi-Square Test of Independence was used to obtain the difference of the respondents' sensory preferences of the three treatments. Findings revealed that the ingredients and tools in making the Bilimbi Fruit (*Averrhoabilimbi*) Juice were minimal, less expensive, and were available in the locale market. Shelf life ranged for 1 to 7 days at room temperature. All treatments of "Bilimbi Fruit" *Averrhoabilimbi* Juice was liked by the respondents in all four attributes. Generally, the result of the study showed that there was a significant difference in the respondents' preferences of "Bilimbi Fruit" *Averrhoabilimbi* Juice in terms of color, flavor, odor, and texture. Thus the null hypothesis is rejected. Research findings showed that "Bilimbi Fruit" *Averrhoabilimbi* Juice was a feasible nutritious Juice Drink safe for human consumption. Hence, a proposed technology guide is offered for the dissemination of the research output.

Keywords— Fruit juice, nutritious, food technology.

I. INTRODUCTION

Fruit juices are popular choices, especially among children and youth. In fact, as observed children and youth get at least one-third of their recommended vegetable and fruit servings from the juice. Although these drinks may seem like a healthy and easy choice, eating fruit is always best.

Fruit Juices are beverages made from different fruit and flavor. There are many known flavors in the market, apple, orange, grapes, pineapple, strawberry and many more. Almost all people are using flavored drink in everyday life. It is also good for one's diet because it helps strengthen the immune system. Fresh juice extracted from fruits and vegetables contains the essential minerals and enzymes which promote healthy digestion.

Bilimbi fruit is commonly called "iba" in Bohol or kamias in most places in the Philippines and is scientifically known as *Averrhoabilimbi* (de Lima, 2001). Bilimbi is abundant in Bohol, Philippines. It is considered as underutilized raw material which is only used as a souring agent in fish dishes.

The researcher has observed that different kinds of fruits are used as Fruit Juice. Hence, she was challenged to venture on producing fruit juice out from bilimbi fruit, which is abundant in the Philippines specifically in Bohol in which this fruit is left underdeveloped. Furthermore, the researcher aimed to promote the consumption of the fruit juice product if found acceptable.

Objectives of the study

The main purpose of this study was to determine the profile, microbial analysis qualities and level of sensory preferences and significant difference of bilimbi fruit juice. The study was conducted at the Bohol Island State University Campuses offering BSIT Food Technology, BHRST, and BSEd TLE for the academic year 2018-2019.

Specifically, it aimed to answer the following questions:

1. What is the profile of Bilimbi fruit (*Averrhoabilimbi*) juice in terms of ingredients and costing; tools and equipment; procedure; shelf- life?

2. What are the sensory qualities and levels of preferences of the respondents on the Bilimbi Fruit Juice in three treatments in terms of color; flavor; aroma; and texture?
3. Is there a significant difference in the sensory preferences of the respondents of the Bilimbi Fruit Juice in three different treatments?

II. METHODOLOGY

Design

Experimental design was used in this study. It involved a single variable of three treatment groups to determine the sensory preferences of Bilimbi Fruit Juice.

Environment and Participants

The locale of the study was on the six campuses of Bohol Island State University (BISU). The six campuses are strategically located in Bohol. BISU Main located at Tagbilaran City, Calape Campus in Calape, Clarin Campus in Clarin both located in the northern part of Bohol. Candijay Campus situated in the eastern part of Bohol. Bilar Campus in Bilar located in the interior part of Bohol, and Balilihan Campus in Balilihan situated in a nearby town from the city.

<i>Research Locale</i>	<i>Number of Respondents</i>
<i>BISU Food Technology Experts</i>	
• <i>Candijay Campus Faculty</i>	4
• <i>Main Campus Faculty</i>	8
• <i>Clarin Campus Faculty</i>	10
• <i>Bilar Campus Faculty</i>	5
• <i>Balilihan Campus Faculty</i>	1
• <i>Calape Campus Faculty</i>	5
<i>BTLED - Home Economics Students</i>	95
<i>BHRST Students</i>	35
<i>People in Different Ages</i>	19
<i>Total</i>	182

Table 1. Research Locale and Respondents Matrix

The University campuses offer programs on Bachelor of Science in Industrial Technology major in Food Technology, Bachelor in Secondary Education major in Technology Education major in Food Technology, and Bachelor in Hotel and Restaurant Service Technology in which food preparation related subjects have been taught in the course.

The latter environment provides an appropriate avenue for the researcher in fielding the food samples to gather data in the sensory qualities and preference level of the innovative juice since they are satellite campuses and securing

permit for product testing was facilitated smoothly. There were 182 respondents who evaluated the product through sensory evaluation, broken down as follows: 33 faculty members in the entire BISU handling Food Technology subjects evaluated the product sensory qualities, 19 persons in different ages and 130 students evaluated the product preference level in the aspects of color, flavor, aroma and texture of the innovated juice. The shelf life of bilimbi fruit juice was observed and rated by the researcher.

Purposive sampling was utilized in determining the respondents. They were chosen according to their ability and knowledge to assess the product quality since they are experts in food preparation. On the other hand, the students and varied age group of respondents were utilized as participants who rated the product's preference level.

Instrument

This study used a self-made questionnaire in obtaining the respondents' assessment of the sensory preference of the bilimbi fruit juice. This includes the juice sensory qualities and the level of preference of the product in terms of color, flavor, aroma and texture. The questionnaire was based on the Hedonic Scale sheet of Gatchalian, where some modifications were made to fit the present study. The following scoring system is observed: (9)- like Extremely, (8)-like very much, (7)-like moderately, (6)-like slightly, (5)-neither like nor dislike, (4)-dislike slightly, (3)-dislike moderately, (2)-dislike very much, (1)-dislike extremely.

In getting the sensory qualities of the bilimbi fruit juice in terms of color, flavor, aroma and texture the respondents simply checked the Likert Scale corresponding to their perceptions. The following scoring was observed:

<i>Scale</i>	<i>Descriptive Rating</i>			
	Color	Flavor	Aroma	Texture
4.21 - 5.00	pinkish	sweet	extremely pleasant	flowy
3.41 - 4.20	light greenish	Sour	slightly acidic	slimy
2.61 - 3.40	greenish yellow	Bitter	very acidic	smooth
1.81 - 2.60	Pink	sweet and sour	slightly pleasant	goeey
1.00- 1.80	yellow	slightly sweet	Unpleasant	sticky

Table 2. Likert Scale

In gathering the data on shelf life, an observation guide was used to keep on track on the changes of the product property at room temperature in a 1-month period of time. To ensure accuracy and substance of each item in the questionnaire, the researcher sought advice from her adviser, a food expert, and submitted the draft to the language critic for corrections and suggestions in both grammar and content.

Procedure

Herewith are the different phases undergoing in the conduct of the study:

Phase I. Permission to conduct the study

Approval from the Dean of the College of Advanced Studies and Campus Director was sought through a formal letter stating the purpose of the study. After securing the approval, the experiment was prepared and performed.

Phase II. Preparation of the Tools

The tools used in the preparation of the juice were the blender, sifter, glass container, measuring cup, measuring spoon, knife, chopping board, spoon, and weighing scale. Assembling all the materials and the ingredients in making the bilimbi fruit juice was made to assure the fast and successful execution of the processes involved in the preparation of the juice.

Phase III. Conduct of the experiment

In preparing the Bilimbi Fruit Juice, there were three (3) treatments utilizing with the same basic ingredients materials and preparation. However, the flavoring ingredients like grapes and apple were added for treatment 2 and 3. Several trials were done before the standard for the bilimbi fruit juice formula was created.

Phase V. Distribution of the questionnaire

Before presenting the product to the participants, clear instruction was given on how to answer the questionnaire. The researcher made sure that every participant had a common understanding of each term and clarification by the participants was entertained. They were given enough time to evaluate the product.

Phase VI. Tasting of the Fruit Juice.

The researcher met the respondents personally and conducted the product tasting. The fruit juice was presented and distributed to the participants, first to the food technology instructors then, to the students, the target consumer. Each respondent tasted the bilimbi fruit juice. The three treatments, of bilimbi fruit juice, were distributed to the respondents one at a time. After tasting each treatment, the student respondents answered the score sheet on their preference; the instructor respondents answered the questionnaire for the sensory quality evaluation of the products. The answered

questionnaires were immediately retrieved, tallied, computed, and interpreted in which findings and conclusions of the study were formulated.

III. RESULT AND DISCUSSION

The main purpose of this study was to ascertain the profile of Bilimbi Fruit (*Averrhoabilimbi*) Juice in terms of ingredients and cost, tools and equipment, procedure, nutritive value, shelf life, and microbial analysis of the juice. Specifically, this study determined the respondent's preferences and its difference in sensory preferences of bilimbi fruit juice in the aspect of color, flavor, aroma, and texture of the three treatments of the juice.

This study used an experimental design. To produce bilimbi fruit juice flavored drinks and to ascertain the difference of the sensory preferences among respondents towards the three treatments of Bilimbi Fruit (*Averrhoabilimbi*), a self-made questionnaire was used and data were analyzed using 9- Point Hedonic Scale and Likert Scale.

The study was conducted on the six campuses of Bohol Island State University. There were 182 respondents who tasted the bilimbi fruit juice. Respondents were composed of 33 faculty members in the entire BISU system handling Food Technology subjects, who evaluated the product sensory attribute; 19 persons of different ages and 130 students who evaluated the product preference level in which they represent the target consumers of the product.

The shelf life was obtained through the use of an observation guide on which the researcher observed the changes of the bilimbi fruit juice sensory qualities in three treatments.

Findings

After a thorough and careful analysis and interpretation of the data gathered, the researcher has found the following results:

1. Profile of Bilimbi Fruit Juice

Ingredients and Cost

The ingredients of Bilimbi Fruit Juice were: 250 grams ripe bilimbi fruit, 150 grams' apple, 150 grams' grapes, 2 cups water, and ½ cup sugar and were available in the local market. The production cost revealed that treatment 1 (plain) was the lowest amounted to ₱17.15 and treatment 2 was the most expensive whose production cost was ₱54.25. Further, treatment 1 and treatment 2 had the same yield which is 3 bottles and treatment 1 had 2.5 bottles. In terms of cost per serving treatment 1 got the lowest cost per serving ₱6.86,

treatment 2 got the highest cost per serving ₱18.00. Therefore, Bilimbi Fruit Juice is affordable and cheaper in terms of production cost and cost per serving compared to those juices that exist in the market.

Tools and Equipment

The researcher used the following tools and equipment to conduct the study: mixing bowl, measuring cup, spatula, glass container, kitchen scissor, sifter, knife, cheesecloth, blender, and weighing scale. All tools used in preparing the bilimbi fruit juice are basic kitchen tools, and handy to work on. The equipment involved like blender and weighing scale are less expensive.

Procedure

In making the Bilimbi Fruit Juice Flavored Drinks, the step-by-step procedures are easy and simple to perform. It employs the conventional process of preparing fruit juice which omits the pasteurization process to preserve the vitamin C content. It includes only washing, cutting, or slicing the fruit, blending, and squeezing to extract the fruit juice.

Shelf-life

The researcher used glass containers as storage of bilimbi fruit juice. The three treatments had the same shelf-life. The product expires 7 days stored refrigerator temperature employing the aid of Vitamin C generally known as ascorbic acid having low pH helped preserve the juice. Shelf life was affected by the type of packaging used. It was also affected by some ingredients that contain preserving properties like sugar and ascorbic acid.

2. Sensory Quality and Level of Preference

Color

Treatment 2 perceived as pinkish was most preferred by the respondents in the aspect of color with a weighted mean of 7.64 described as like very much. Treatment 1 perceived as greenish yellow gained the second rank with a weighted mean of 7.60 described as like very much and treatment 3 perceived as greenish yellow gained the last rank with a weighted mean of 7.32 described as like very much. In terms of color level of preference, the majority of the respondents liked very much the color of the three treatments.

Flavor

In the aspect of flavor, treatment 1 and treatment was perceived by the respondents as sweet and sour, and treatment three was perceived by the respondents as sweet. As to preference level, treatment 3 got the highest weighted mean 7.47 described as like very much, treatment 1 got the second rank 7.31 described as like very much, treatment 2 got the lowest rank with a weighted mean of 7.25 described as like

very much. It was revealed that the respondents liked very much the flavor of the three treatments. Among the three, treatment 3 was most preferred by the respondents as to its flavor maybe it's because of the apple added as flavoring.

Aroma

Treatment 1(Bilimbi Fruit Juice) aroma was rated as liked slightly described as slightly acidic. Treatment 2 described as slightly pleasant and was liked moderately, and Treatment 3 described as Slightly pleasant and was also liked moderately in terms of aroma. It was found out that treatment 2 and treatment 3 whose aroma was pleasant was most favored by the respondents in terms of aroma. The acidic aroma of the juice shows unfavorable preference among the respondents.

Texture

The data disclosed that all treatments had the same texture which perceived by the respondents as flowy. As to preference level treatment 3 got the highest rating 7.43 described as like very much, treatment 1 got the lowest rating of 7.25 described as like very much, however, all treatments were rated by the respondents as liked very much.

3. Difference in the sensory preferences

There was a significant difference in the respondent's sensory preference level among the three treatments in terms of color, flavor, texture, and aroma of bilimbi fruit juice. Among the three treatments, treatment 3 apple flavor was most preferred by the respondents. Thus the null hypothesis was rejected since the data reveals that the computed Chi-Square value of all treatments and sensory preferences was higher than the critical value at 0.05 level of significance and 14 degrees of freedom.

IV. CONCLUSION

Bilimbi Fruit Juice produced from bilimbi fruit and flavorings such as apple and grapes, it uses sugar as a sweetener. Samples incorporated with flavoring have a higher preference than plain. Treatment 3 had a higher preference than treatment 1 and 3 in color, flavor, aroma, and texture. Therefore, Bilimbi Fruit Juice in different treatments are all acceptable and preferred by the respondents. No detected level of hazardous or harmful bacteria in Bilimbi Fruit (Averrhoabilimbi) Juice. It contains nutrients that are within the recommended dietary value which are healthy and useful for human consumption. Hence, Bilimbi Fruit Juice is a feasible nutritious juice to be produced for consumption.

V. RECOMMENDATIONS

1. Future researchers may also subject treatment 1 and treatment 2 for microbial analysis to assure the safety of the product.
2. The researcher may improve the odor of plain Bilimbi Fruit Juice to make it more distinctive and appealing to smell.
3. The administration may provide financial assistance for further production of Bilimbi Fruit Juice as an Income Generating Enterprise of the university.
4. Community immersionists may adopt this innovation of fruit juice to augment the Bilimbi Fruit market value in the community.
5. Entrepreneurs may consider the production of this bilimbi fruit juice flavored drink production as one of their business ventures.
5. The administration may collaborate with various extension linkages in promoting the Bilimbi Fruit Juice innovation to the community and the market as well.
6. Farmers may consider cultivating more Bilimbi Fruit to support the raw material demand when the product is mass-produced for commercialization.
7. The researcher may secure the intellectual property protection of the product by patenting its process and composition.
8. Future researchers who wish to undertake parallel study may try other flavors and ingredients of bilimbi fruit juice using local fruit juices (e.g., increase the proportion of bilimbi fruit or use other flavorings).

REFERENCES

- [1] Article XIV Section 10 of the 1987 Philippine Constitution, Science and Technology are Essential for National Development and Progress. Retrieved date: January 05, 2018at09:48AM.<http://www.Officialgazette.gov.ph/constitutions/the-1987-constitution-of-the-republic-of-the-philippines-1987-constitution-of-the-republic-of-the-philippines-article-xiv/>.
- [2] Browns, A. (2015) .*Understanding Food: Principles and Pre-Parathion second edition*.
- [3] Bueker, J. (2002) .*Ayurvedic balancing: an integration of Western fitness with Eastern wellness*.Llewellyn Worldwide, pp.25-26/188.
- [4] Bunch, Farrah A., (2019) *Benefits of Kamias for Human Dr. F.* , Natural Remedies. <https://www.drfarrahmd.com/2018/08/be...>
- [5] Canning, A.(1985) "VINEGAR BREWING", Nutrition & Food Science, Vol. 85 Issue: 5, pp.20-21.
- [6] Caolil, Mena A., et.al.,(2017) *Acceptability of Kamias (Averrhoabilimbi) Wine.*, Mindoro State College of Agriculture and Technology – Calapan City, Campus .
- [7] Oh DeokGeun., (2017) Producing Method for fruit- vegetable Juice with Paprika and Apple and its fruit – vegetable Juice., Seoul F&B Co LTD.
- [8] Jain,S.,et.al., (2004). *Vitamin C Enrichment of Fruit Juice Based Ready- to Serve Beverages Through Blending of Indian Gooseberry (EmblicaofficinalisGaertn.) Juice*. Department of Horticulture, Narain College, Shikohabad 205135, Uttar Pradesh, India; Division of Post-Harvest Technology, Indian Agricultural Research Institute, New Delhi 110012.
- [9] Joseph, J.,et.al.,(2009). *Oxalic Acid Content of Carambola And Bilimbi*.Miami, Florida (USA), Inter-American Society for Tropical Horticulture, p.117-120.
- [10] Koster, E.P. &Mojet, J. (2006). Theories of Food Choice Development
- [11] Lee C.Y., Mattick L.R. (1989) Composition and Nutritive Value of Apple Products. In: Downing D.L. (eds)Processed Apple Products. Springer New York, NY
- [12] Love, K., Paull, and R. E. (2011). *Hawaii Tropical Fruit Growers, & CTAHR Department of Tropical Plant and Soil Sciences*. Bilimbi Fruit and Nuts College of Tropical Agriculture and Human Resources, University of Hawai'I, (June),1-6.
- [13] Mathew, L. wt.al., (1993). Flowering and fruit development in Averrhoabilimbi L., South Indian Horticulture. Kerala, v.41, n1, p.41-42,1993.
- [14] Maslow, A.H. (1943). Theory of human motivation.
- [15] Meghwal, M. (2015). *Benefits of food colours and safety*. Ingre redients in South Asia.
- [16] Morton, J. (1987). *Bilimbip*.128-12 *Fruits of Warm climat* Julia F. Morton, Miami, FL.
- [17] O'Connor L., et.al., (2013). *Dietary energy and its Association with the nutritional quality of the diet of Children and teenagers*. J NutriSci 2: e10.
- [18] O'Neil CE, et.al., (2012) *100% Orange juice consumption is Associated with better diet quality,improved nutrient Adequacy, decreased risk for obesity,and improved Bio-markers of health in adults*. National Health and Examination Survey,2003-2006. Nutr J 11:107.
- [19] Osboron, A. (2016). *Creativity is an art of extending imagination to produce useful ideas*. Retrieved date: August 2018 at 05:12 PM from <http://tipstech.org/creativity-act-turning-new-and-imaginative-ideas-reality-guest-lecture-mrs-arunachalam-creativity-19>
- [20] Savithri, et. al., (2009) *Studies on the Antihyperlipidemic Properties of Averrhoabilimbi Fruit in Rats*, Plants Med. 75 (1) 55-58.
- [21] Sengupta, Sushmita (2018)*Apple Fruit Benefits: 8 Incredible Health Benefits of Apple That You May Not Have Known. Food and Drinks*.<https://food.ndtv.com/food-drinks/apple->

fruit-benefits-8-incredible-health-benefits-of-apple-that-you-may-not-have-known-1761603

- [22] Serpen, JY (2012). *Comparison of sugar content in bottled 100% fruit juice versus extracted juice of fresh fruit*. Food NutrSci 3: 1509-1513.
- [23] Solymosi ,K.,et.al. (2015). *Food colour additives of natural origin*. Color Additives for Foods and Beverages.
- [24] Schumpeter, J. (2007). Theory of Innovation by Schumpeter. Retrieved on September 19, 2018 from <https://en.Wikepedia.org/wiki/>
- [25] Ware, Megan, 2017. *What are the health benefits of grapes?* <https://www.healthline.com/nutrition/benefits-of-grapes>
- [26] Wong, K., C.; Wong, and S.N. (1995). *Volatile constituents of Averrhoabilimbi L. fruit journal of Essential oil Research*, Carol Stream, v.7,n.6,p.691-693,1995.